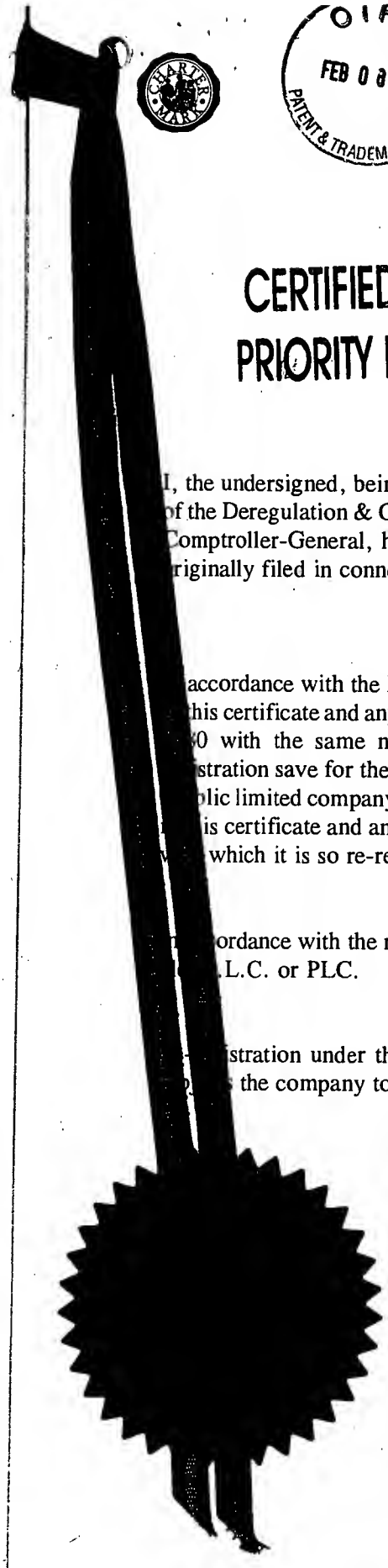

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I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

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Dated: 6 December 2001

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2611

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	BALDOCK, MARK R.
Application No.:	09/997,170
Filing Date:	11/30/01
For:	PREDICTIVE TUNING ON MULTI-TUNER BROADCAST DATA RECEIVERS
Art Unit:	2681

TRANSMITTAL OF PRIORITY DOCUMENT

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Director for Patents and Trademarks
Washington, D.C. 20231

Dear Sir:

Enclosed herewith is a certified copy of British Patent Application No. 0029464.5 for which the above-identified patent application claims priority from.

If, for any reason, this priority document is not acceptable, please inform the undersigned as soon as possible.

Respectfully Submitted

HEAD, JOHNSON & KACHIGIAN

Date: 02/08/02

Customer No. 24,118

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"EXPRESS MAIL" Mailing Label No. EL779649743US
Date of Deposit: February 8, 2002
I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington D.C. 20231 by Amy Miles

Amy Miles

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Patents Form 1/77

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The Patent Office

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Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office
Cardiff Road
Newport
Gwent NP9 1RH

1. Your reference **GW-G30598**

02 DEC 2000

2. Patent application number
(The Patent Office will fill in this part) **0029464.5**

P01/7700 0.00-0029464.5

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Pace Micro Technology Plc

Victoria Road
Saltaire
Shipley
BD18 3LF

Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

TS 8856901

4. Title of the invention

Predictive Tuning on Multi-Tuner Broadcast Data Receivers

5. Name of your agent *(if you have one)*

Bailey Walsh & Co.

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

5, York Place
Leeds
LS1 2SD

Patents ADP number *(if you know it)*

224001

6. If you are declaring priority from one or more earlier patent applications, give the and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / years)*

7. If this application is divided or otherwise derived from an earlier UK application, the earlier application

Number of earlier application	Date of filing *(day / month / years)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer "Yes" if:*

a) any applicant named in part 3 is not an inventor, or

b) there is an inventor who is not named as an applicant, or

c) any named applicant is a corporate body

See note (d)

Yes

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document.

Continuation sheets of this form	
Description	7
Claim(s)	
Abstract	
Drawing(s)	

10. If you are also filing any of the following, state how many of each item.

Priority Documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(Please specify)*	

11. I/We request the grant of a patent on the basis of this application

Signature

Date **01.12-00**

12. Name and daytime telephone number of person to contact in the United Kingdom

G Wood
0113 2433824

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Notes

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b) Write your answers in capital letters using black ink or you may type them.

c) If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.

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e) Once you have filled in this form you must remember to sign and date it.

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Predictive Tuning on Multi-Tuner Broadcast Data Receivers

The invention to which this application relates is a Broadcast Data Receiver (BDR) of the type which is used to receive data, typically digital, which is broadcast from a remote location. The data is typically transmitted from a broadcast location to a plurality of receiving locations, such as domestic premises. The data can be transmitted via any of a number of methods such as, satellite transmission systems, cable transmission systems or terrestrial broadcast systems.

In this type of system the BDR can receive the data in an encoded form which is designed to maximise the amount of data which can be carried in the data stream. At the BDR, the data is decoded and processed to allow the generation of audio, video and/or auxiliary information via a display screen such as that of a television set, which is connected to the BDR or provided as an integral part thereof.

The data carried is transmitted in "streams" of data which are typically "carried" to the receiving locations on a series of RF carriers. In practice this means that typically the data, audio, video and auxiliary, for a particular channel and a number of the said channels are carried on each of the carriers.

Thus, when a user of the system wishes to change channels using any of the conventional channel changing methods, if the original channel data is located on the same RF carrier as the data for the newly selected channel, the change to the new channel, can take place relatively quickly with no, or minimal, delay to the viewer, so that the change appears to be instantaneous. However, if the data for the original and newly

selected channels are on different RF carriers there can be a problem as follows.

When the user selects a channel which is to be generated from data on a transport stream carried on an RF carrier which differs to that on which the original channel data was carried a conventional BDR causes the same tuner to navigate from the original channel on one RF carrier to the selected channel on another carrier. As this occurs there is inevitably a brief delay as the tuner loses lock on the "outgoing" transport stream, acquires the "incoming" stream required and the audio and video decoder starts to receive stable transport data for the new channel.

The aim of the invention is to eliminate this delay where possible.

In a first aspect of the invention there is provided a broadcast data receiver for broadcast digital data, said receiver including a plurality of tuners for selective tuning independently to receive one of a range of data RF carriers and wherein a first tuner is controlled to receive data for a channel in accordance with user requirements and if another tuner is free it is tuned to an RF carrier and/or channel differing to that to which the first tuner is tuned, based on a prediction made by the control means for the BDR.

In addition or alternatively, the said another tuner can be tuned to receive data for a specific channel which is on the same RF carrier as that to which the first tuner is receiving.

Typically the spare tuner resource of the multi-tuner BDR is used to acquire an RF carrier in anticipation of a subsequent channel change on the basis of the prediction of user behaviour.

In some instances the first tuner may be used to tune to an RF carrier on which a user selected programme data is carried and such data received, and processed, to generate a television programme at that time. In certain instances the BDR can perform a secondary function wherein the further tuner can be used to receive a second RF carrier and data received therefrom, stored for subsequent retrieval. The stored data can be held in a memory such as a hard disc drive, video tape or the like for user retrieval as and when the user requires.

If the tuner is not used for this secondary purpose at any time the secondary tuner is effectively free and, in a preferred embodiment, when the BDR does identify that this is the case, it performs a user prediction to identify a channel and RF carrier for the same and, based on this can tune the spare tuner into, if necessary the RF carrier, on which the predicted channel is located.

This therefore means that subsequent to the channel prediction operation, if the user does select the predicted channel and/or a channel which is carried on the predicted RF carrier, the BDR can immediately change to receive the data from the said second tuner, thus eliminating any delay which conventionally occurs when the same tuner moves between RF carriers.

Typically, the prediction is undertaken on the basis of previous user channel selection data which is stored in a memory and accessible by the control means for the tuners. Thus in accordance with a further aspect of the invention there is provided a method of tuning into a channel wherein the original channel selected is identified as part of the prediction process and, with reference to that channel, data relating to a channel or channels which have been subsequently selected by the user on

previous occasions is held in a memory and referred to and from this data a subsequent channel selection is predicted and an unused or free tuner of the BDR is tuned to the appropriate channel or RF carrier for the same.

In one embodiment it is the RF carrier on which the identified channel is carried which is identified and the unused or free tuner is used to tune into the appropriate carrier, preferably before the user makes the said channel selection.

Typically, if the user selects a channel which is different to the predicted channel then the conventional tuning procedure can be performed to obtain the selected channel.

In a further embodiment, if a number of further tuners are provided then a number of predicted channels can be selected and the carriers tuned to.

The box monitors the user's real-time channel-surfing behaviour and attempts to predict the users next action and set up the front-end resources appropriately to eliminate a delay in changing RF carriers. When the current usage pattern does not require all tuners to be locked to specific carriers, any spare tuning capability can be assigned to predictive tuning as a background activity.

Should the usage profile change, for example, if the user initiates data stream recording from one RF carrier whilst continuing to watch a channel from another, predictive resources are freed for the primary application's use. Thus in a preferred embodiment the predictive tuning can be resumed when resource availability permits. Depending upon the prediction algorithm and the spontaneity or eccentricity of the user, the system's "guestimate" of the next carrier may be right

or wrong but will, in many cases, match the user's responses thus improving apparatus performance and the consumer experiences fewer frustrating pauses, especially when rapidly surfing channels and, to the user the BDR is perceived to be more responsive to their selections.

In a specific embodiment of the invention the control system for the BDR monitors the user's recent history of remote control key presses and determines that, in this example, the last three events were all "Channel Up" actions. Consequently, the control means software concludes that the next action is likely also to be a "Channel Up" action by the user with a high degree of probability. If the user is currently watching a programme on a particular channel and the BDR software does not require the second tuner to perform a secondary service the BDR software determines from the user's channel list the next predicted channel, in this case the next ascending channel. The predicted channel is identified as being on a different RF carrier and conventional tuning to it at the time of user selection would introduce a delay. However according to the present invention and having the second BDR tuner available to it, the BDR sets the second tuner for the new predicted RF carrier at the earliest possible opportunity and in advance of the user pressing the "Channel Up" key. As soon as the next user selection is made and if it is in accordance with the prediction the control means can switch the demultiplexer from one transport stream to the next with minimal delay as the "incoming" transport stream for the predicted carrier will already have stabilised as it is being received on the second tuner so that all that is required is for the BDR to change between tuners from which the data is processed and then create the newly selected channel.

In one embodiment the following procedure is followed in accordance with the invention.

The BDR maintains a set of user tuning "events", for each of which there is a record of the frequency of occurrence over some period of time (say since the BDR was last switched on) and, optionally, over the lifetime of the box. For each event there is also a "running score", which is a weighted probability of occurrence of the associated event.

Events are defined for each user interaction (by front panel or remote control) that would potentially affect the tuning to incoming carriers. For example, the set might include events, "the use has just changed downward a channel in the numerically ordered list of favourite channels" and "the user has just selected a specific channel by number". Events can be generic, as in the first example, or specific, as in "the user has just selected their third most frequently watched channel". They can also be defined in relation to the user's preferred (favourite) channel listing, which is already generally maintained by BDR's.

Each time an event is detected, the frequency of occurrence is incremented, and added to the running score. Thus, over time, the factor added to the running score for a given event will be proportional to the frequency and probability of the event occurring again.

At equal intervals, the running scores for all events are reduced by a constant factor, modelling the passage of time. This accounts for user behaviour over the shorter term. Although a particular event may be the most common one performed by the user (e.g "channel up") it may, nevertheless, not have been undertaken for a considerable period. By reducing the weighting with time, the event becomes progressively less significant until it occurs again.

At any given time, the carriers to be tuned predictively are assigned to the available tuning resources in descending order of running score. For this purpose, the events are logically sorted by descending score. The actual carriers are read from the channel listing table as needed. For example, if the user is on channel 2 and the prediction is "channel up", the carrier for channel 3 is looked up. If the user is currently watching channel 10, the prediction is "channel up", the carrier for channel 11 is looked up. Note that some predictive events would identify a carrier already tuned in which case that action would be ignored and the next highest probability event taken into account.

The interval of prediction is adjusted by frequency of use3r interaction, i.e. if the user is surfing rapidly through channels, the predictions need to be made more frequently, with a maximum limit determined by the minimum data acquisition time, there is no point in returning before stable data is received.

Thus an improved usage of the system is achieved in accordance with the invention.

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